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Beekeeping Expertise as Situated Knowing in Precarious Multispecies Livelihoods

Abstract

In this article I analyse beekeeping expertise as situated knowing in the precarious conditions of multispecies livelihoods. Beekeeping is knowledge-intensive: to keep the colonies alive and thriving, to produce honey and to support pollination – that is, to maintain livelihoods –distinct expertise is required. The conditions in which beekeeping expertise is developed and enacted are precarious, given the close entanglements with the ultimately unintelligible non-human others and their changing habitats. Using ethnographic and interview data collected among urban beekeepers in Finland, I first describe the precariousness embedded in beekeeping as sharing lifeworlds and becoming with non-human others, particularly in an epoch characterised by severe environmental disturbances. Second I analyse learning and practicing beekeeping as ways of developing and enacting beekeeping expertise as situated ways of knowing. In beekeeping courses, through books and in social relations beekeepers learn not only the skills needed but also ways of knowing that value diversity and variability. By practicing and observing on the hive yard, they further learn to be affected by the bees and their multispecies habitats, attuning their practices and perceptions in accordance with them. Beekeeping expertise therefore entails ways of knowing which are local, relational, practical and open to changes and even surprises, recognising the incompleteness of knowledge, as well as the unprecedented agency of non-human others. Such situated knowing enables acknowledging and acting on the complex interdependencies of multispecies livelihoods in changing socio-ecological conditions.

Keywords: beekeeping, expertise, multispecies livelihoods, precariousness, situated knowing

Introduction

Knowledge and skill are at the core of successful beekeeping. Knowledge of bee behaviour and local environments as well as skillfulness in beekeeping practices are essential when striving towards healthy bee colonies, abundant honey yield and effective pollination. Knowledge and skill that distinguish beekeepers from non-beekeepers, that is, beekeeping expertise (see Ericsson 2018, 3–4) is entangled with the survival and wellbeing of both the beekeepers and their colonies, and, especially through pollination, of a wider community of plants and animals dependent on them, including human food producers and consumers (Potts et al. 2010).

In this article I argue, that beekeeping expertise not only contributes to but is also constituted within everyday livelihood practices. Following Dall'Alba's (2018, 2009) phenomenologically informed approach, I explore beekeeping expertise as ”enacted and embodied rather than possessed or applied as independent

entities" (Dall'Alba 2018, 35). Dall'Alba calls into question the assumed separateness of experts, their knowledge and domains of expertise, and instead suggests exploring them as comprising "an inescapable entwinement", calling for the recognition of the relation between "persons and the world" in expertise research (ibid. 34; Dall'Alba 2009). This entails an ontological turn in the research of expertise and expert performance, where knowledge and skill are integrated into expert ways of being, and developing expertise is therefore a continuing process of becoming (Dall'Alba 2018, 35).

Such onto-epistemological conceptualisation of expertise is based on understanding knowledge as situated (e.g. Dall'Alba 2009 11, 23). Situated ways of knowing are embedded in local and particular relations, refusing to presuppose a metaphysical or transparent knowing subject (Haraway 1988). Although practice-oriented and place-based, situated knowledges are not detached from translocal material-semiotic arrangements, but rather it is essential to recognise their situatedness in the global and embodied relations in which they are constituted (ibid.; Alhojärvi 2017; Vehviläinen 2017). In situated knowledges, these relations include humans and non-human entities alike: the world in its whole more-than-human diversity is understood as an active actor and agent in knowledge production (Haraway 1988, 592–593). Therefore the approach can also be seen as engendering openness towards contingency and surprises, whether serendipitous or dreadful (Alhojärvi 2017; Haraway 1988; see also Sedgwick 2003).

Situated ways of knowing are characteristic to small-scale food production (Gonzlez 2001; Hyvärinen 2017; Vehviläinen 2014; see also Le Heron et al. 2016), and beekeeping is no exception. Learning beekeeping has been described as a contextualised enskilment process by Adams (2018), highlighting the practical and social ways of developing beekeeping expertise. Maderson and Wynne-Jones (2016) in turn understand beekeepers as producers of citizen science through making observations and keeping records, but also analyse beekeeping as entailing "other ways of knowing" (ibid. 92), including intuitive elements, emotions and a holistic engagement with the bees. Accordingly, especially in the context of urban small-scale beekeeping, Moore & Kosut (2013) stress corporeality and intimacy as constitutive parts of the embodied and experiential knowledge of beekeeping.

As these studies suggest, the expertise relation between "persons and the world" (Dall'Alba 2018, 34) in beekeeping is particularly intense. Similarly to other forms of food production, in beekeeping the most substantial material conditions of survival and wellbeing are at stake. The process of becoming an expert in food production is therefore intertwined with processes of reproduction – of becoming in its most fundamental form, going all the way down to the materiality of the body and the soil (see Haraway 2008; Vehviläinen 2014). Following Haraway (2008), food production can be understood as a continuous process of becoming with in the mutually constitutive networks of companion species (ibid. 17–19, 244; see also Hyvärinen 2017 and Vehviläinen 2014). The practices of fulfilling subsistence needs are always already entangled with the lives and livelihoods of non-human others: there is nothing preceding the multispecies mesh we are (in).

In order to conceptualise these processes of becoming with as embedded not only in bio-physical cycles and conditions but also in social, cultural and political institutions and arrangements, I have developed the

concept of multispecies livelihoods[1]. As an economic category without the historical baggage or disciplinary power of 'economy' or 'economics', livelihoods are open to diversity of activities, skills, knowledges, sites of action and relations "that cannot be captured by a generality" as is the case of hegemonic capitalocentric economic discourses but instead are "linked to particular contexts, stories and strategies" (Miller & Gibson-Graham, forthcoming; see also Miller 2019). Multispecies livelihoods can therefore be defined as the diverse and particular practices of securing the necessities of life through sharing lifeworlds with human and non-human others.

Beekeeping is a particular example of multispecies livelihoods. Not only do beekeepers partially support themselves[2] through a close engagement with Apis mellifera and a variety of plants, pests and parasites involved, but beekeeping also contributes to survival and wellbeing far beyond the immediate participants of its enactment. At the same time beekeeping is also seriously affected by changes in bee habitats, often – ironically – caused by other practices of food production in its industrialised forms, but also rapidly proceeding climate change (Potts et al. 2010). As detailed below, the intimacy and complexity of these multispecies networks render beekeeping a precarious livelihood, not (only) in terms of unstable income and material welfare, but rather, following Tsing (2015) as embedded in the unprecedented encounters between species and in the existential instability in the face of environmental disturbances of planetary scale.

In order to explore the intense and unstable relations of expert knowledge in beekeeping, I ask in this article, how expertise as situated ways of knowing is developed and enacted in precarious multispecies livelihoods of beekeeping. The article is organised as follows: Next I describe the research data and methods. In the analysis to follow, I first explore beekeeping as a precarious multispecies livelihood characterised by uncertainties embedded in multispecies encounters and changing socio-ecological conditions. Second I examine, how beekeeping expertise is developed as skills and practices but also as ways of knowing, and how it is further enacted in the various relationalities of the hive yard and beyond. As a conclusion I discuss the meaning of fostering ways of situated knowing that are grounded in everyday practices and interdependencies of multispecies livelihoods.

Research data and methods

Research methods include focus group interviews and ethnography, combined with thematic analysis. In addition to the theoretical approaches described above, the research methodology is inspired by multispecies ethnography, in which the interdependencies of humans and non-human species is brought at

[1] In Finnish, I have previously used a similar concept, keskinäinen toimeentulo to indicate the entanglement of material subsistence and relational multispecies ethics (Hyvärinen 2017).

[2] In Finland, most beekeepers define themselves as either hobbyists or part-time beekeepers, whereas only 1–3 % declare practicing beekeeping as a fulltime job (Ruottinen et al. 2003, 51). However, even small-scale beekeepers earn income by selling their honey (see Hyvärinen, forthcoming).

the centre of inquiry, challenging the dualisms and hierarchies inscribed within human-centered ethnographies (Kirksey & Helmreich 2010). The research data was collected mainly in 2017 in two major cities in Southern Finland. In addition, supplementary autoethnographic material was gathered throughout 2018 and in early 2019.

Two group interviews (2 hours each) were conducted with total 14 beekeepers from the urban or semi-urban areas. The interviewed beekeepers, women and men aged from 35 to 77 tend their colonies mainly on their house yards in suburban areas, and had experience varying from two to 47 years of beekeeping. Number of colonies per interviewed beekeeper varied from zero[3] to around 50, and amount of honey produced last year from 7 to over 800 kgs. Interviews were recorded and transcribed, and the citations were translated by the author. Background data was collected through a short questionnaire. In this article, the interviewees are marked with consecutive numbering in each citation separately.

Autoethnographic data consists of recorded dialogues and an online beekeeping diary from 2013 until 2019. I have kept bees with my father from 2013, and currently we have nine colonies in two apiaries. Our apiaries have been located in the outskirts of a public park, in a semi-public community garden and on a domestic yard near the city centre. The autoethnographic dialogues (seven recordings, varying from 18 to 105 minutes) followed loosely a mind map of different beekeeping practices, and they took shape of performance appraisals, evaluating past years and coming up with improvements. The beekeeping diary (currently 40 pages) is written by us both after every hive visit on an online platform.

Ethnographic participant observation took place in a three-day urban beekeeping course organised by an urban beekeepers' association in spring 2017 with around 10 participants. The course provided with basic information on bees and beekeeping, with an emphasis on urban specificities such as pastures in the city, neighbours and licenses. Two of the course days were indoor lecturing (3 hours each day) and the third day a field trip to the teacher's home apiary (around 2 hours). The lectures were recorded and loosely transcribed, and field notes were written after the field day. Only the course teacher is cited in the analysis.

The data was classified following the initial thematisation made before and during data collection. Knowledge was one of the themes from the beginning and a question related to learning and knowing was posed in both of the group interviews. However, knowledges and skills appeared to be an issue widely discussed also in other parts of the interviews, as well as during the beekeeping course and in the autoethnographic dialogues. Interview and observation data sections that included discussion about knowledge, skill and related issues were extracted and analysed further abductively through the initial forms of the conceptualisation of multispecies livelihoods, decoding the data from the perspective of interspecies relations and diverse economic practices.

[3] The interviews took place in spring, and one beekeeper had lost all her colonies during the winter.

Precarious multispecies livelihoods

Beekeeping can be described as troublesome engagements with honeybees and their lifeworlds. It is sometimes argued, that bees occupy a subordinate position similar to other production animals in relation to their keepers, who are, in principle, capable of deciding over their future. Bees are not, however, confined and controlled the way domestic animals are, nor are their bodies usually consumed as in the case of livestock (Nimmo 2015, 187–190). Due to their relatively independent agency with which the beekeeper has to comply in order to maintain the colonies and produce honey, bees' activities are often described in social terms as work or labour (see Sjödin 2016), and human-bee relationships therefore as a sort of collaboration or cooperation (e. g. Chandler 2010). However, working with bees does not imply mutual understanding or even recognition. Bees, as any insects, remain ultimately unintelligible from a human perspective (Raffles 2011, 44), rendering beekeeping as always potentially surprising (cf. Nimmo 2015, 191).

> Beekeeper: The elegancy lies in that when you then go to the hive yard you don't know at all what to expect [--] bees are so unpredictable, but then you can always find your way.

Bees appear as capricious in the hive yard, but also in their interaction with their surroundings: for example, it is not easy to predict in detail, where the bees will forage, even though in general it is known which plants they favour.

> Beekeeper 1: [--] Once we took [the hives] to [a locality nearby], besides a buckwheat field, but we didn't get any buckwheat honey, maybe some multicoloured hempnettle got a little.
> Beekeeper 2: Yes it was a weed of buckwheat and there was hugely of it [laughs]. It was quite fine, flowery, kind of very liquid, light in colour, but buckwheat we didn't get.

The honey was not what expected, but a pleasant surprise with its fine taste and appearance. However, the unpredictable behaviour of bees can also have outcomes that are more problematic: bees sharing a water source with children can cause controversies in the neighbourhood, given their ability to protect themselves with painful and even lethal[4] stings:

> Beekeeper: [--] we had a beach nearby and the sand then, it was an awfully good drinking place, even though I had all kinds of contraptions for water sources that I had made near the apiary, but they went there [--], but the children did not learn to beware of them, but they went there [for water].

As illustrated by the quote above, it is not often the bees themselves but rather their unintentional interaction with humans in their habitats that can cause disquiet and concern. This type of uncertainties is particularly present in urban contexts, where relating with neighbours and passers-by is often an inseparable part of beekeeping. Accordingly, swarming[5] is often considered to be more of a problem in urban environments than in rural: bees find many human-made cavities as suitable places for a new hive,

[4] Bee stings can cause systemic allergic reactions, including anaphylaxis, in 0,3–7,5 % of the population according to different studies (Bilò & Bonifazi 2009).

[5] Swarming is a way for bee colonies to reproduce: part the colony's bees leave the hive in order to find a place for a new one.

causing various troubles by blocking chimneys and ventilation pipes, and possibly even leading to damage in building structures:

> Beekeeper: Yeah, they are not nice inside the wall, a hundred kilos of honey and pollen and bees molding there, you'll get moisture damage with less than that.

Swarming is extensively discussed in the data, and it can be considered as exemplifying the unpredictability of bees: during the swarming season, one can rarely be sure the bees are not going to swarm. Swarming symptoms can be monitored and precautions taken, but none of the existing techniques for preventing swarming is absolutely certain. Furthermore, catching a swarm can be an adventure, as beekeepers often vividly describe, and if it is not from the beekeeper's own colonies, it cannot be known for sure what the bees' breed is or which diseases and parasites they are possibly carrying.

Swarming is not only inconvenient and counterproductive in terms of diminishing honey yields, but also risky for the bees, as most feral colonies do not survive the winter, partly due to human-induced changes in bee lifeworlds. Honeybees are not native in Finnish latitudes, and maintained colonies are prepared for the winter usually by feeding them with sugar syrup and making sure the colony can keep warm and dry in the hive, and undisturbed from birds and mice. Moreover, also feral colonies in areas where honeybees are native nowadays struggle to survive due to spreading of the varroa mite (Locke 2015). The mite is originally a parasite of Eastern honeybee (Apis cerana), but during the last decades it has spread through international bee trade to Western honeybee (Apis mellifera) colonies almost worldwide (Oldroyd 1999).

As another prevalent multispecies precarity in beekeeping, the varroa mite was also comprehensively discussed in the data. In managed colonies as well, mite is often involved in winter loss (Guzman-Novoa et al. 2010), which in Finland varies from 10 to 15 % of colonies annually (Ruottinen et al. 2003, 110). Mite itself does not kill the colonies but makes the bees weaker and vulnerable to bacteria and viruses such as the deformed wing virus (Wilfert et al. 2016). Mites cannot be totally eradicated from infected colonies, but their amount can be monitored and controlled[6]. However, uncertainty prevails:

Beekeeper 1: With that varroa there should be some better way. [--]

Beekeeper 2: I have been astonished that so many experienced beekeepers have encountered enormous losses during the last few years.

Beekeeper 1: It is difficult, so difficult.

Beekeeper 3: It does surprise.

Beekeeper 1: And it is so complicated that, one year in the outermost hive there was a terrible amount of mites, in the others – none. But in the following spring they were all over again.

[6] In Finland, annual use of oxalic acid is nowadays considered as the bare minimum for varroa treatment, and if the amount of mites is monitored to be too high, additional measures such as treating the colony with formic acid or thymol or removing drone brood are recommended (Ruottinen et al. 2003, 43, 155–165).

The varroa mite is told to surprise beekeepers with its unexpected behaviour, but also applying the chemical treatment unsuccessfully can result in continuous increase in mite populations and therefore contribute to winter loss. In turn, chemical techniques themselves can have adverse effects on bee colonies, especially if applied incorrectly. It is then not only the mite itself but also the treatments that evoke uncertainty among beekeepers.

As illustrated by the varroa mite, the precariousness of beekeeping is not unrelated from diverse translocal formations of global economies and ecologies (see Phillips 2014; Suryanarayan & Kleinman 2013, 223–224, 232). Contamination of bee habitats by pollution and pesticides serves as another example. Bees have a "finely calibrated interrelationship with the local environment" (Nimmo 2015, 191), which makes them particularly susceptible to environmental changes. Beehives can be exposed to various hazardous substances, such as agricultural pesticides especially when located in intensive farming context (Calatayd-Vernich et al. 2018), and heavy metals in urban areas (Perugini et al. 2010). The pervasiveness of toxins in bee lifeworlds is no surprise for beekeepers:

> Beekeeper: [--] of course there are all sorts of residues [in nectar] but they are then different toxins in the countryside than in the city.

Lastly, the climate emergency as epitomizing the precariousness of the current epoch changes weather conditions and blooming seasons around the world, therefore affecting bees and beekeeping practices alike. The research data was collected primarily in spring 2017, which in Northern Europe was exceptionally cold. In spring, the weather-related troubles in beekeeping are at the most severe: food storages are running dry, and colonies can die of hunger or fall behind in raising the new generation of bees if the weather is not good enough for spring blossom and forage. In turn, the exceptionally warm summer the year before was similarly unsettling, as plants bloomed way too early for the bees to forage, affecting honey yields substantially (SML 2016).[7]

Beekeeping is about relating with unintelligible others, particularly the bees, in different localities and conditions, and producing livelihoods in and through that relating. This renders beekeeping as inherently indeterminate and uncontrollable. Furthermore, the human-induced environmental uncertainties entail ultimately an existential precarity, at least for the bees themselves: there are severe regional declines in both wild and managed bees due to reasons presented above and habitat loss and fragmentation in addition, and especially because of the interaction between these drivers[8]. Not only do bee declines directly affect the livelihoods of their keepers, but uncertainties in beekeeping are also entangled with the

[7] Interestingly, climate change was not explicitly discussed in the beekeeping course nor in the interviews, although local weather conditions were commented upon. It is to be noticed, however, that the interviews were conducted before the publication of IPCC's report in the autumn of 2018, which can be seen as a turning point in public discussions on climate change.

[8] In Finland, declines of managed honeybees have yet not been reported, but populations of native pollinators have declined (Hokkanen et al. 2017).

overall precariousness of the current epoch, given the significance of pollination for food production, or of insects in general for functioning ecosystems. (Potts et al. 2010.)

Developing and enacting beekeeping expertise

Precarious multispecies livelihoods form an unstable ground on which beekeepers operate and on which expertise is developed and enacted. I first explore the process of becoming an expert in beekeeping by analysing, how beekeeping is learned in courses, through books and in social relations, not only in terms of skills and practices but also as ways of knowing. Second, I examine how beekeepers enact expertise on the hive yard and in its surroundings through relating with the bees and their multispecies habitats.

My way, your way and the correct way

Beekeepers-to-be usually start by attending a beekeeping course, lead by an experienced beekeeper and providing basic information on bee behaviour and beekeeping practices. Most beekeepers in the interviews had attended a course or several, and many had also studied beekeeping through books, particularly the two volume book "Beekeeping in practice" (Mehiläishoitoa käytännössä, Ruottinen et al.) from 2003 and 2005, which is considered as the basic textbook on modern Finnish beekeeping. The book is published by the Finnish Beekeepers' Association (Suomen Mehiläishoitajain Liitto, SML), which in addition provides educational materials online for both beginner and advanced beekeepers, and a bi-monthly magazine for its members, estimated 80 % of all beekeepers in Finland (SML 2019). Even though there is a plethora of other resources on bees and beekeeping especially online, it can be argued that in Finland SML plays a significant role in the formation of beekeeping expertise (cf. Adams 2018; Maderson & Wynne-Jones 2016).

Through basic courses and SML materials, beginner beekeepers are familiarised with a roughly uniform way of keeping bees, which can be described as honey-centered or at times even close to a productivist approach, characterised by, for example, the use of frame hives[9] and preferring sugar for winter food instead of honey. However, there is still room for experiential knowledges and diverse practices. For instance, in every issue of the magazine there is a column written by “the beekeeper of the year”, covering the regular beekeeper's thoughts and descriptions of their everyday practices, and at the end of the beekeeping manual (Ruottinen et al. 2003) there are three different real life descriptions of ”beekeepers at work”. Accordingly, teachers of beekeeping courses often share their own experiences, views and practices, in addition to the more formal knowledge on bee behaviour, beekeeping and honey production. In the urban beekeeping course, the teacher straightforwardly distinguished their small-scale practices from those of ”honey producers”:

> Teacher: When I move from one hive to another, I wipe the gloves and the hive tool with lemon balm, because it erases the smell of the previous hive [--] If I was a honey producer there wouldn't

[9] Different beekeeping approaches are often distinguished by the use of different hive types. In Finland vertical frame hives, either wooden or styrofoam, are the default hive types. With movable honeycomb built in frames they enable easy inspections and management practices, as well as efficient honey extraction with centrifuges, which have in turn made possible industrial honey production (see Spiers & Lewis 2015).

> be time for this kind of things, I wouldn't think, but as they are there on my yard I can do as I will. I think this is pleasant.

It is not only the teachers or beekeepers selected by the SML who get to share their personal experiences and practices with others. Peer learning is common in beekeepers' social events, such as seminars and local meetings, and on online platforms especially in social media, resulting in further diversification of possible beekeeping practices and knowledges. Whereas beginner beekeepers often lean on books, instructions learned in the courses and advice from more experienced beekeepers, later on each beekeeper tend to develop their own ways of doing: as the saying goes, there is my way, your way and the correct way of keeping bees. Often the variation is in details: to settle the bees during hive inspections one can use either smoke or water spray; if necessary to feed the colonies in the spring, one can either give them ready-made or homemade sugar paste, sugar syrup, dry sugar or honey. Sometimes, however, beekeepers also invent and experiment with novel practices, such as keeping the queen at the top of the hive instead of at the bottom box, or attempting at preventing swarming by maximising honeycomb building with empty frames. Also new devices are being invented, including, for example, bags and boxes for swarm catching and solar or steam powered beeswax smelters. The inventions can be adopted by other beekeepers and even gain a more formal position in beekeeping publications if they prove useful. However, they might also prove inoperative: ”it works in theory”, diagnosed a beekeeper of a wax smelter build from an old dishwasher.

Whether working or not, the extensive variation, experimentation and development of new practices and devices exemplify pointedly the heterodox and open-ended nature of beekeeping knowledge. In its diversity, curiousity and creativity, beekeeping expertise can be argued as entailing potential for adaptation in respect to the precariousness described in the previous section. The ongoing process of learning to live with the varroa mite is an example of such adaptation. Different treatments to reduce the amount of mites in hives have been and still are experimented with, together with scientific as well as layperson attempts to breed varroa resistant bees. Beekeepers who have been following the field for decades remember not only the treatments since rejected but also the easiness of beekeeping before the mite:

> Beekeeper 1: But this mite, we haven't much discussed about, but it is such a nuisance, for decades now and they were medicated then whatever mycin there was and then they had to, it was prohibited because there were residues of it in honey. Now we have this oxalic acid and...
> Beekeeper 2: At that time there was no mite at all, at the beginning, there have been such times as well in Finland with the bees. In the 80s the mite arrived.
> Beekeeper 3: Beekeeping was so easy back then [laughter].
> Beekeeper 2: Without any concerns one could add antibiotics, there was no harm [laughter] and in the autumn the honey was harvested.
> Beekeeper 3: But especially that the mite was not to worry about, there was hardly any winter loss.

The beekeepers above recall not only the time when the varroa mite had yet not spread to Finland, but also the time of loose regulation of chemical use. Easiness is therefore linked not only to the absence of the parasite, but also to the absence of knowledge on the adverse effects of chemicals or policies regulating their use. Put in this context, spreading of the mite appears almost as just another change occurring in beekeeping practices over time: despite the mite, beekeeping continues, only with a bunch of new

practices included. In relation to the mite, beekeeping expertise is then enacted as the ability to incorporate new knowledges and transform the existing expert ways of being.

Nevertheless, the precariousness of multispecies livelihoods cannot be totally managed even by diligently keeping up with the newest developments of the field. It is a commonly shared view among beekeepers, that beekeeping can never be fully mastered, but instead learning beekeeping is an ongoing process. Knowing beekeeping can even get more complicated the more experience one gains:

> Beekeeper 1: [--] you can use 24 hours per day with one hive, marveling at everything. And all the time feeling more and more stupid.
> [--]
> Beekeeper 2: [Former chair of SML] says that when the course is over, then the beekeeper after three years knows the most about bees, and then it becomes different the knowledge because you can keep them differently as well.

Even the experienced beekeepers rarely claim a position of an all-knowing expert, but rather the possibility of making mistakes or being surprised by the bees or other actors involved is made visible by sharing experiences of unsuccessful beekeeping. Beekeepers(-to-be) are therefore familiarised to a culture of inevitably making but also sharing one's mistakes - and learning from others' stumbling. Swarming is again a case in point: even though experience can bring some advantages, swarming is an inescapable trouble potentially for any beekeeper. The beekeepers' discussions around swarms are often loaded with twisted humour which can be understood as a means of dealing with the shared experience of uncertainty and unsuccessful attempts of preventing swarming.

> Beekeeper 1: [--] I also warned [the neighbours] of it that if there are swarms in your chimney someday, I'll come and get them. I probably wouldn't go myself, but promised altogether.
> Beekeeper 2: Although they are not your bees.
> Beekeeper 1: Alth- they are not. My bees are all in the hive.
> Beekeeper 2: You can see yourselves, there they are.

Humour here is based on the assumption that unlike beekeepers, the neighbours do not know the details of bee behaviour: despite the apparent failure in preventing swarming, beekeepers still enact expertise, which distinguish them from non-beekeepers. Failures do not appear to question the expertise of a beekeeper but embracing the uncertainties rather serves as a site for developing it. Becoming an expert beekeeper therefore entails developing ways of knowing which not only value the diversity and changeability of practices and knowledges, but also engender openness towards surprises, even the troublesome ones.

”One should aim at understanding”

Beekeeping is substantially learned by doing: however important the courses, books and on- and offline social relations are, the most essential place for developing beekeeping expertise is the hive yard (Adams 2018). When entering the hive yard, novice beekeepers soon notice, that beekeeping requires more than meticulously following the instructions from courses or books:

> Beekeeper 1: My first summer and well into the second as well went quite panicking somehow, that in the course it was said that and in the book is says like this, and this is not quite like that, I remember that, with [a friend] we kept the bees and both were there like, luckily we are not alone,

we ponder there something like that, and all terrified to do anything, because if I do something wrong, and then little by little realising that, well, that we'll see then.
Beekeeper 2: I can vividly recall that stage, few first years when there is the beekeeper's manual open on the side and another one, Tuomanen's, what was it, a book from the 40s where it says what has to be done during raspberry blossom and I don't even know when raspberries bloom, and then blackcurrant blossom [laughs]. Then I open the hive and I'm all baffled, like, then what, but in the course of years it eventually became more clear.

Implementing the instructions in practice can seem even terrifyingly complex for beginners. This is not, however, solely due to their lack of expertise. For experienced beekeepers as well, even relatively unambiguous instructions are not always straightforward to accomplish in practice. For example, it is nowadays recommended that frames with old, dark honeycomb should not be placed in the hive[10] in order to prevent diseases, and instead they should be melted to collect the valuable bee wax. However, the bees' tendency to collect pollen to the dark combs complicates the decision making over which frames are to be placed in the hive. When the comb is melted, the pollen is wasted – but if the dark comb is placed in the hive, the queen might lay eggs on it, which prevents removing the comb.

Interviewer: [--] what do you do with the dark honeycomb then? [--]
Beekeeper 1: There is probably some amount of pollen usually, which would be nice to put back to the hive. Full pollen frames, I don't really melt them before the pollen is eaten.
Interviewer: Isn't it then a problem when they start to use them again, and then comes also brooding there?
Beekeeper 1: Yes, they have to be placed near the walls or somewhere so that you can get them from there. It just has to be planned, I don't really know how but. [--] if for example now one is taking dark frames out of the hives, I don't dare to take full pollen frames out.
Beekeeper 2: Well they are not worth melting either.

Deciding which comb is to be placed in the hive requires understanding of how the pathogens and bees behave, as well as taking into account the local conditions, such as low temperatures during the spring in question. The recommendation of not to place dark comb in the hive is therefore combined by the perceived needs of the particular colony in the particular conditions: instead of straightforwardly adopting the formal instruction, it is contextualised in relation to the bees and their lifeworlds.

Reflecting the instructions in respect to one's own colonies, local ecologies and particular beekeeping practices can be understood as actively and purposefully relating with the bees and their multispecies habitats, which, I argue, is an essential part of beekeeping expertise and entail ways of knowing which are situated in the local particularities of the bee colony in question. In practice, relational expertise is enacted, as described above, in how beekeepers carefully make the conditions such for the bees that they can wish for a desired outcome (Nimmo 2015, 189) – or, when the efforts prove futile, in the ways beekeepers

[10] When using frame hives most beekeepers reuse the frames from previous years: when new brood boxes or honey supers are added to the beehive in spring or summer, they often include a combination of old frames with ready built honeycomb and new frames with a wax foundation. Fresh honeycomb is white, but gets darker over time because of brooding and pollen stains.

respond to the unexpected, adapting their plans and actions in accordance to the bees, as shown by bee diary notes of less successful hive inspections over the years:

> June 8th 2014: We were thinking about making a nucleus hive from the hive number one for raising queens, but as there were no larvae, there was probably not a queen either. We did not make the nucleus. [--]
> June 26th 2015: In [another] apiary raising a queen did not succeed on top of the hive number three. [--] We made a nucleus for raising a queen on top of hive number two.
> July 1st 2018: [--] When making an artificial swarm [last time] the queen had ended up to the hive with the foraging bees, and there were eggs. We added another brood box there. [--]
> July 12th 2018: [In this] apiary the colony on which the artificial swarming method was performed tried to swarm again but returned to the hive. We made another artificial swarm [--].

Regular hive inspections as the most direct encounters with the bees are particularly intense in terms of producing local and relational knowledges. During hive inspections, the bee colonies are observed in terms of flight rate and routes, egg laying, brood, honey and pollen as well as possible symptoms of swarming or diseases. Observation is multisensory: good eyesight is essential, but also weight, smell and sound of the colony are often taken note of (see Moore & Kosut 2013). In addition to hive checks, in the urban beekeeping course observing the bees by just sitting beside a beehive was encouraged as a way of developing beekeeping expertise.

> Teacher: If you want to learn how the bees act, you should take a chair and put it near the hive, [--] and just sit there and look at the bees. You can learn a lot when you see how they fly and what are they busy with there. At first, it all looks the same but then you start to kind of understand what happens. And then you can also sort of figure out gradually what happens inside from what happens outside. In that way, one should aim at understanding.

In the process beekeepers themselves are subject to change: careful observation makes them more receptive to the signals of bee behaviour and increases understanding of bee lifeworlds. Effects of such relating can reach beyond the hive yard, where beekeepers might start to perceive the weather and plants from a perspective affected by the bees (Maderson & Wynne-Jones 2016, 93; Moore & Kosut 2013): cold spring means there is not enough willow pollen to feed the larvae, rain during raspberry blossom means losing a considerable portion of honey yield and hard wind engenders a possibility of displacing the hive roofs. Beekeeping is then not only about relating with the bees themselves but with their habitats as well. The relationship can become affectionate, as illustrated by the words of a beekeeper, who had lost all of her colonies during the winter. Through losing colonies, she had also lost the particular way of relating with the environment and changing seasons, as well as the habit of visiting the hives.

> Beekeeper: [--] now this has been all torture this spring, as I view to the nature and I cannot look if my bees are flying or not, and there is no reason to go to the hives, except for to dead hives.

Bees' close attachment to the local ecologies means that beekeeping practices differ geographically: beekeeping in the Northern latitudes is characterised by a short intensive period of honey production and a long winter, and when it comes to colony development and blooming seasons, even a rather small distance can make a difference which affects beekeeping practices. Accordingly, the varying microclimate on the hive yard and quality of bee pastures, that is, plant species and their abundance play a role: for example, in

some areas bee colonies forage honeydew[11] every year whereas in other places it is a rare delicacy – or trouble. Beekeepers with such pastures have to adjust their practices to take into account the honeydew forage, resulting even in contesting the instructions of SML and experienced beekeepers:

> Beekeeper 1: [--] it must be done in August, the autumn [varroa] treatment with the poison. And I have reputedly done, [the beekeeping counsellor of SML] said that one mistake that I have made is that I have done it too late.
> Beekeeper 2: And it's not true.
> Interviewer: The August treatment or that...?
> Beekeeper 1: August treatment, because I haven't done it in August but in September, as I get so much honeydew every year, and I have to get it out from the hive, understandably, and then it has been too late. But I cannot start harvesting in the middle of August, the final harvest.
> [--]
> Beekeeper 3:[The beekeeping teacher] was terrified that good grief, you are really not until in September making the winter preparations, giving winter food then, whereas I should have been at the beginning of August, according to [the teacher].

The local bee-related ways of knowing might also contest other hegemonic ways of knowing. Bees forage in a variety of plants, including some that are considered as harmful invasive species from a mainstream conservationist perspective. However, a beekeeper might rather perceive the non-native plants such as Canadian goldenrod (solidago canadensis) and Himalayan balsam (impatiens glandulifera) as valuable sources of late autumn pollen and nectar:

> Beekeeper: I have been bemoaning a bit that nowadays these invasive species are scolded so much and everyone wants to weed them. The Himalayan balsam that is, even though it has of course spread all over, but it is a good extension to the forage season.

The problematics of invasive plant species is contextualised and examined from a situated beekeeping perspective, suggesting a possibility of mutual benefit. Accordingly, when examined from a local and particular perspective, even such severe environmental concerns as pollution can be framed as something to get along with.

> Beekeeper 1: And then it needs to be remembered that the life span of a single bee is so short that not so much accumulates in it.
> Beekeeper 2: Yes, and it sacrifices itself the bee it uses them...
> Beekeeper 3: It filtrates them to itself. [--] Only thing that one could worry about [in the city] maybe is that how those heavy metals get to pollen, it is of course when the production of pollen is emphasised, I myself haven't felt like selling [pollen] from urban areas to anyone. Myself I have then eaten selectively the pollen from my own hives, but.

The beekeepers quoted above refer to studies, which indicate that bees' bodies act as filters absorbing the harmful substances from nectar, reducing their concentration in honey. When it comes to pollen, a beekeeper above outlives the trouble by selecting which products are suitable for sales and which only to be used by himself, which can also be understood as a sort of filtering. Furthermore, in the discussion the

[11] Honeydew is a sugary liquid, secreted by aphids and some other insects as they feed on plant sap. It is collected by honeybees occasionally in early autumn. Dew honey is valued but often considered as poor winter food for the bees.

customers' concern of possible residues in honey is framed as not exclusively characteristic to bee products of urban areas or even less of a trouble in cities: whereas the air and soil might be polluted in the cities, in rural areas plants are ”poisoned”, that is, treated with pesticides.

> Beekeeper 1: Well I have always told [to honey customers] that in France they made a study that honey produced in Paris is much cleaner than that produced in the countryside, I have always told that and [the customers] then do believe it's the case.
> Beekeeper 2: In the countryside they spray with poison anyway, the plants.

Pollution is then not understood as an overwhelming obstacle for beekeeping, inevitably leading to unlivable futures, but it is discussed and known of through relating with the bees who are capable of filtrating the harmful substances so that colony health won't be affected, or through relating with bee products, which can be selected for sales and appear as relatively pure when compared with other areas. Beekeeping expertise is therefore enacted as staying with the trouble of pollution (cf. Haraway 2016), as well as the troubles of mites, pathogens, swarms, and invasive plant species described above: it is not only situated to the needs of the particular bee colonies but also in the wider relations and arrangements of precarious multispecies livelihoods.

Conclusions

Beekeeping is a process of multispecies becoming: bees' relation to their environments is co-constitutive particularly through foraging for nectar and pollinating plants[12] and therefore relating with the bees means also participating in maintaining and producing livelihoods far beyond beekeepers' personal sphere. These processes and practices of co-constitution are characterised by precarity, as the shared lifeworlds and livelihoods of humans, bees, plants and various others are inescapably and irreparably defined by climate change, pollution, pesticides and invasive parasites, which add to and mix with the uncertainties inherent in relating with the unintelligible non-human others. As such, beekeeping can be thought of as analogous to matsutake foraging, examined by Tsing (2015): it might as well ”allow us to explore the ruin that has become our collective hone” (ibid. 3). As a multispecies livelihood practice beekeeping can be understood as co-habitation and a continuous process of exploration of the changing relations and relationalities between actors of different species (cf. Haraway 2008). Honeybees, co-constitutively with their keepers, have so far proved adaptive enough to continue maintaining their and others' livelihoods in disturbed environments, at least in the least affected areas of the world.

Relating with the significant but indifferent others in these ruins that we now inhabit is a staggering stage for developing expertise. In this article, I have analysed beekeepers' expertise as being developed as an ongoing and open-ended process where formal instructions are layered with personal and shared experiences and observations of particular bee colonies and their localities. Beekeeping expertise is

[12] As elaborated in the beekeeping course, there is also a plethora of other co-constitutive relations arranged around a beehive, from spreading fertilising excrements and genes by drone bees to establishing social bonds through selling bee products and collaborating with other beekeepers.

enacted in close relation with the bees but also with their multispecies habitats: beekeeping cannot be learned or known without sharing one's lifeworld with the bees and being affected by them. Such close engagement has transformative potential in terms of fostering new practices and knowledges – ways of relating with the bees and beyond (see Tsing 2015, 20). Becoming an expert beekeeper means therefore not only managing beekeeping skills but entails also developing relational expert ways of being (see Dall'Alba 2009; 2018).

Beekeeping expertise can be understood as situated knowledge production organised around various everyday troubles of beekeeping in varying socio-ecological conditions. In situated knowledges of beekeeping, the precariousness of multispecies livelihoods is recognised and acted upon in a local and particular ways. It is not knowing from above but requires active participation and diligent engagement with the mundane, minor details and variable particularities, which are, however, constantly being constituted in relation to by the complex translocal socio-economic and ecological networks. Therefore, situated knowing in beekeeping is always incomplete and constantly in flux: local conditions vary, new techniques are developed, formal instructions change and can be contested. In its openness to change and orientation towards variation, situated knowing in beekeeping is curious and creative, and potentially transformative in relation to existing knowledges.

The mundane attempts of recognising and acting on the precariousness of multispecies livelihoods are often complicated and even bound to fail from time to time. But although troublesome or even tragic at times, beekeeping is performed as informed action throughout the season, year in, year out. Exploring the possibilities of life and livelihoods with the bees and their various others is an engagement that the beekeepers often meet with such a joy that it ”almost feels like remembering the possibility of future” (Alhojärvi, forthcoming). After all, as Haraway (2016, 55) reminds, in precarious times ”the world is not finished and the sky has not fallen – yet”, still fostering ”modest possibilities of partial recuperation and getting on together” (ibid. 10). In addition to definitely being a practice of becoming with, perhaps beekeeping is or can become also a practice of such possibility of composing a livable world, given its response-able and surprise-able ways of knowing, as in leaving space open for both care and response (ibid. 105) and the unprecedented possibilities of coexistence within environmental disturbances (ibid. 10, 98; Tsing 2015). Developing expertise as an inescapable entwinement in precarious multispecies livelihoods is at least a meaningful engagement with the more-than-human worlds, and situated knowing in beekeeping engenders good enough ways of living with others in conditions of precariousness: possibilities of getting along with non-human and human others in complex networks of interdependencies that are both vulnerable and resilient. Such knowing can prove useful in the era of socio-ecological emergencies, invoking different epistemologies and fostering different futures.

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